



2811  
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**In re Application of:**

Eugene P. Marsh

**Serial No.:** 09/651,620

**Filed:** August 30, 2000

**For:** PROCESS FOR THE FORMATION  
OF RuSixOy-CONTAINING BARRIER  
LAYERS FOR HIGH-k DIELECTRICS

**Confirmation No.:** 1130

**Examiner:** H. Vu

**Group Art Unit:** 2811 ✓

**Attorney Docket No.:** 2269-4218US  
(99-0796.00/US)

CERTIFICATE OF MAILING

I hereby certify that this correspondence along with any attachments referred to or identified as being attached or enclosed is being deposited with the United States Postal Service as First Class Mail on the date of deposit shown below with sufficient postage and in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Commissioner for Patents  
P.O. Box 1450  
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Sir:

In compliance with the duty to disclose information material to patentability pursuant to 37 C.F.R. § 1.56, it is respectfully requested that this Supplemental Information Disclosure Statement be entered and the documents listed on attached Form PTO-1449 or PTO/SB/08 be considered by the Examiner and made of record. Copies of the listed documents are enclosed pursuant to 37 C.F.R. § 1.98(a).

In accordance with 37 C.F.R. § 1.97(g) and (h), filing of this Supplemental Information Disclosure Statement is not to be construed as a representation that a search has been made or an admission that the information cited herein is, or is considered to be, material to patentability as

defined in 37 C.F.R. § 1.56(b). Further, no representation is made by Applicant herein that no other possible material information as defined in 37 C.F.R. § 1.56 (b) exists.

U.S. Patent Documents

<u>U.S. Patent No.</u>	<u>Publication Date</u>	<u>Patentee</u>
US - 4,250,210	02/1981	Crosby et al.
US - 4,982,309	01/1991	Shepherd
US - 5,080,862	01/1992	Luthra
US - 5,126,016	06/1992	Glennings et al.
US - 5,130,172	07/1992	Hicks et al.
US - 5,241,137	08/1993	Kiribayashi
US - 5,286,675	02/1994	Chen et al.
US - 5,314,727	05/1994	McCormick et al.
US - 5,352,488	10/1994	Spencer et al.
US - 5,525,181	06/1996	Bruckner et al.
US - 5,529,953	06/1996	Shoda
US - 5,614,795	03/1997	Kim
US - 5,618,761	04/1997	Eguchi et al.
US - 5,662,815	09/1997	Kim
US - 5,705,442	01/1998	Yen et al.
US - 5,729,054	03/1998	Summerfelt et al.
US - 5,742,322	04/1998	Cranton et al.
US - 5,874,174	02/1999	Okuda et al.
US - 5,885,750	03/1999	Hsiao et al.
US - 5,994,034	11/1999	Maehata
US - 6,197,628	03/2001	Vaartstra et al.

Foreign Patent Documents

<u>Document No.</u>	<u>Publication Date</u>	<u>Patentee</u>
JP 9031042	02/1990	Watabe et al.

Other Documents

- Cowles et al., Chemical Communications, p. 392, 1969.
- Green et al., "Chemical Vapor Deposition of Ruthenium and Ruthenium Dioxide Films", J. Electrochem. Soc., Vol. 132, No. 11, pp. 2677-2685, Nov. 1985.
- Simpson et al., "Atomic Layer Epitaxy," Chem Br., Vol. 23, No. 1, pp. 37-38, 40, Jan. 1987.
- Hirva et al., "Theoretical Studies on the Growth Mechanisms of Silicon Thin Films by Atomic Layer Epitaxy," Surface Science, 220, pp. 137-151, 1989.
- Gregory et al., "Conditions for the Deposition of CdTe by Electrochemical Atomic Layer Epitaxy," J. Electrochem. Soc., Vol. 138, No. 5, pp. 1279-1284, May 1991.
- Koleske et al., "Growth of Si on (100) via H/Cl Exchange and the Effect of Interfacial Boron," J. Appl. Phys., Vol. 72, No. 9, pp. 4073-4082, 1 Nov. 1992.
- Norton et al., "Organometallic Chemical Vapour Deposition of Platinum and Gold: Heterogeneous Deposition and Surface Chemistry," Surface Science, 307-309, pp. 172-176, 1994.
- Borup et al., "Electrochemical and Vacuum Behavior of Carbon Monoxide and Lead Coadsorbed on Platinum (111)," J. Electroanalytical Chem., Vol. 374, pp. 235-244, 1994.
- Aquino et al., "Evidence for a Surface Methylene Species in the Decomposition of Trimethylgallium on GaAs(100)-(4x1): A High Resolution Electron Energy Loss Spectroscopy Study," Surface Science, Vol. 327, pp. 74-80, 1995.
- Ylilammi, "Monolayer Thickness in Atomic Layer Deposition," Thin Solid Films, Vol. 279, pp. 124-130, 1996.
- George et al., "Surface Chemistry for Atomic Layer Growth," J. Phys. Chem., Vol. 100, pp. 13121-13131, 1996.
- Liao et al., "Characterization of RuO<sub>2</sub> Thin Films Deposited on Si by Metal-Organic Chemical Vapor Deposition," Thin Solid Films, Vol. 287, pp. 74-79, 1996.
- Silmon et al., "Thickness Profiles of Thin Films Caused by Secondary Reactions in Flow-Type Atomic Layer Deposition Reactors," J. Phys. D: Appl. Phys., Vol. 30, pp. 1725-1728, 1997.
- Min et al., "Atomic Layer Deposition of TiN Films by Alternate Supply of Tetrakis (ethylmethylamino)-Titanium and Ammonia," Jpn. J. Appl. Phys., Vol. 37, pp. 4999-5004, 1998.

Applicant offers to supply any explanation or discussion of the documents which the Examiner feels is necessary or desirable and which is requested.

Serial No. 09/651,620

This Supplemental Information Disclosure Statement is filed after the mailing date of the first Office Action on the merits.

The fee pursuant to 37 C.F.R. § 1.17(p) is enclosed.

Respectfully submitted,



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Date: November 10, 2003

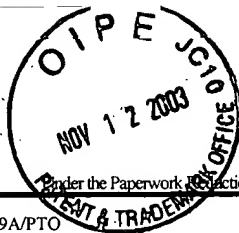
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**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**

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Sheet 1 of 2

**Complete if Known**

Application Number	09/651,620
Filing Date	August 30, 2000
First Named Inventor	Eugene P. Marsh
Group Art Unit	2811
Examiner Name	H. Vu
Attorney Docket Number	2269-4218US (99-0796.00/US)

**U.S. PATENT DOCUMENTS**

Examiner Initials *	Cite No. <sup>1</sup>	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number - Kind Code <sup>2</sup> (if known)			
		US-4,250,210	02/1981	Crosby et al.	
		US- 4,982,309	01/1991	Shepherd	
		US- 5,080,862	01/1992	Luthra	
		US- 5,126,016	06/1992	Glenning et al.	
		US- 5,130,172	07/1992	Hicks et al.	
		US- 5,241,137	08/1993	Kiribayashi	
		US- 5,286,675	02/1994	Chen et al.	
		US- 5,314,727	05/1994	McCormick et al.	
		US- 5,352,488	10/1994	Spencer et al.	
		US- 5,525,181	06/1996	Bruckner et al.	
		US- 5,529,953	06/1996	Shoda	
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		US- 5,618,761	04/1997	Eguchi et al.	
		US- 5,662,815	09/1997	Kim	
		US- 5,705,442	01/1998	Yen et al.	
		US- 5,729,054	03/1998	Summerfelt et al.	
		US- 5,742,322	04/1998	Cranton et al.	
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		US- 5,994,034	11/1999	Maehata	
		US- 6,197,628 B1	03/2001	Vaartstra et al.	

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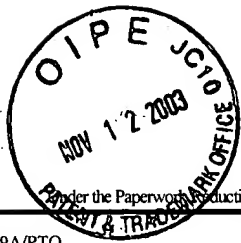
Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T <sup>6</sup>
		Country Code <sup>3</sup> - Number <sup>4</sup> - Kind Code <sup>5</sup> (if known)				
		JP 9031042	02/1990	Watabe et al.		X

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Sheet 2 of 2

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First Named Inventor	Eugene P. Marsh
Group Art Unit	2811
Examiner Name	H. Vu
Attorney Docket Number	2269-4218US (99-0796 00/US)

### OTHER PRIOR ART -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No. <sup>1</sup>	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>2</sup>
		Cowles et al., Chemical Communications, p. 392, 1969.	
		Green et al., "Chemical Vapor Deposition of Ruthenium and Ruthenium Dioxide Films", J. Electrochem. Soc., Vol. 132, No. 11, pp. 2677-2685, Nov. 1985.	
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		Koleske et al., "Growth of Si on (100) via H/Cl Exchange and the Effect of Interfacial Boron," J. Appl. Phys., Vol. 72, No. 9, pp. 4073-4082, 1 Nov. 1992.	
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		Silmon et al., "Thickness Profiles of Thin Films Caused by Secondary Reactions in Flow-Type Atomic Layer Deposition Reactors," J. Phys. D: Appl. Phys., Vol. 30, pp. 1725-1728, 1997.	
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